REMARKS

I. Information Disclosure Statement

The Office Action dated June 29, 2004 (I.e., hereinafter referred to as the "Office Action") indicated that the Information Disclosure Statement (IDS) filed on January 29, 2004 fails to comply with 37 CFR 1.98(a)(2), which requires a legible copy of each cited foreign patent document; each non-patent literature publication or that portion which caused it to be listed; and all other information or that portion which caused it to be listed. The Office Action indicated that the IDS filed on January 29, 2004 has been placed in the application file, but the information referred to therein has not been considered. The Office Action referred to the following items from the IDS dated January 29, 2004:

Page 1 of 7: The Office Action indicated that the document number 6,282,530 does not have the correct date and therefore does not know which patent application is intended to list. The Applicant is submitting herewith a copy of U.S. Patent No. 6,282,530. It is believed that the submission of this document now complies with 37 CFR 1.98(a)(2).

Page 2 of 7: The Office Action indicated that the document number EP 1 069 206 A2 does not have the correct date and therefore does not know which patent application is intended to list. The Applicant is submitting herewith a copy of EP 1 069 206 A2. It is believed that the submission of this document now complies with 37 CFR 1.98(a)(2).

Page 3 of 7: The Office Action indicated that the other prior art "Nanotubes for Electronics", page 69 is missing. The Applicant is submitting herewith a copy of

this article. It is believed that the submission of this document now complies with 37 CFR 1.98(a)(2).

The Office Action indicated that the other prior art "Aligning single-wall carbon nanotubes with an alternating current electric field" is missing. The Applicant is submitting herewith a copy of this article. It is believed that the submission of this document now complies with 37 CFR 1.98(a)(2).

Page 4 of 7: The Office Action indicated that the other prior art "Purification of Single Wall Carbon Nanotubes by Microfiltration", page 8842 is missing. The Applicant is submitting herewith a copy of this article (pages 8839 to 8841). The Applicant does not have a copy of page 8842. It appears to the Applicant that the article "Purification of Single Wall Carbon Nanotubes by Microfiltration" ends on page 8841 rather than page 8842 and that the reference to page 8842 as the ending page of the document should actually have been page 8841. It is believed that the submission of this document now complies with 37 CFR 1.98(a)(2).

Page 5 of 7:

The Office Action indicated that the other prior art "Evolution of Avalanche Conducting States in Electrorheological Liquids" is duplicate with item #2 on page 4 of 7. The Applicant is submitting herewith a copy of this article. It is believed that the submission of this document now complies with 37 CFR 1.98(a)(2).

The Office Action indicated that the other prior art "Rapid Communication Orientation and Purification of Carbon Nanotubes Using AC Electrophoresis" is missing. The Applicant is submitting herewith a copy of this article. It is believed that the submission of this document now complies with 37 CFR 1.98(a)(2).

Page 7 of 7: the Office Action indicated that the other prior art "Building Blocks for Electronic Spiking Neural Networks" is duplicate with the last item on this page. The Applicant is submitting herewith a copy of this article. It is believed that the submission of this document now complies with 37 CFR 1.98(a)(2).

The Office Action additionally indicated that the IDS filed on October 7, 2005 fails to comply with 37 CFR 1.98(a)(2) in that the other prior art "Nanoparticles Get Wired" is missing. The Applicant is submitting herewith a copy of this article. It is believed that the submission of this document now complies with 37 CFR 1.98(a)(2).

The Applicant submits that the previously submitted IDS documents are now in compliance with 37 CFR 1.98(a)(2) due to the submission of the aforementioned documents/articles and other patent references. The Applicant respectfully requests that the submitted items included herewith be entered and considered by the Examiner as part of the originally submitted IDS referred to above by the Examiner.

II. Specification

The Office Action objected to the disclosure because of the following informalities: on page 2 of 100, paragraph [001], the Office Action indicated that "ant-Hebbian" is misspelled. The Applicant is therefore amending the specification to correct this error.

III. Claim Rejections 35 U.S.C. § 102

Requirements for Prima Facie Anticipation

A general definition of *prima facie* unpatentability is provided at 37 C.F.R. §1.56(b)(2)(ii):

> A *prima facie* case of unpatentability is established when the information *compels a conclusion* that a claim is unpatentable under the preponderance of evidence,

> burden-of-proof standard, giving each term in the claim its broadest reasonable construction consistent with the specification, and before any consideration is given to evidence which may be submitted in an attempt to establish a contrary conclusion of patentability. (*emphasis added*)

"Anticipation requires the disclosure in a single prior art reference of each element of the claim under consideration." *W.L. Gore & Associates v. Garlock, Inc.*, 721 F.2d 1540, 220 USPQ 303, 313 (Fed. Cir. 1983) (citing *Soundscriber Corp. v. United States*, 360 F.2d 954, 960, 148 USPQ 298, 301 (Ct. Cl.), *adopted*, 149 USPQ 640 (Ct. Cl. 1966)), *cert. denied*, 469 U.S. 851 (1984). Thus, to anticipate the applicants' claims, the reference cited by the Examiner must disclose each element recited therein. "There must be no difference between the claimed invention and the reference disclosure, as viewed by a person of ordinary skill in the field of the invention." *Scripps Clinic & Research Foundation v. Genentech, Inc.*, 927 F.2d 1565, 18 USPQ 2d 1001, 1010 (Fed. Cir. 1991).

To overcome the anticipation rejection, the Applicant needs to only demonstrate that not all elements of a *prima facie* case of anticipation have been met, *i.e.*, show that the prior art reference cited by the Examiner fails to disclose every element in each of the applicants' claims. "If the examination at the initial state does not produce a prima face case of unpatentability, then without more the applicant is entitled to grant of the patent." *In re Oetiker*, 977 F.2d 1443, 24 USPQ 2d 1443, 1444 (Fed. Cir. 1992).

Thakoor, et al.

Claims 1-7, 9-11, and 13-20 were rejected by the Examiner under 35 U.S.C. 102(b) as being anticipated by Thakoor et al (hereinafter referred to as "Thakoor"), "Solid-state thin-film memistor for electronic neural networks".

Regarding claim 1, the Office Action argued that Thakoor teaches a system, comprising:

a physical neural network configured utilizing nanotechnology (the Office Action cited "title" in support of this argument), wherein said physical neural network comprises a plurality of nanoconductors which form neural connections between pre-synaptic and post-synaptic components of said physical neural network (the Office Action cited page 3132, left column, lines 24-41 of Thakoor in support of this argument); and

a learning mechanism for applying Hebbian learning to said physical neural network (the Office Action cited page 3133, left column, lines 1-14 of Thakoor in support of this argument).

The Applicant respectfully disagrees with this assessment. Thakoor at page 3132, left column, lines 24-41 does not make any mention of nanoconductors, nor pre-synaptic and post-synaptic components of a physical neural network. Thakoor does refer generally to "neural network architectures" and "synapses" (see page 3132, left column, lines 22-24), but does not provide for any disclosure, teaching or suggestion of nanoconductors, and pre-synaptic and post-synaptic components of a physical neural network. Thakoor only refers generally to "neural network architectures" but does not describe a physical neural network and instead teaches a "memistor" device, which is not a physical neural network as taught by Applicant's invention. The memistor device taught by Thakoor can be adapted for use with an electronic neural network as indicated by Thankoor. The Thakoor reference, however, does not actually disclose a physical neural network as taught by Applicant.

Thakoor also does not provide any teaching anywhere of nanoconductors and pre-synaptic and post-synaptic components as taught by the Applicant's invention. The Applicant provides for a teaching of "nanoconductors," which is not taught by Thakoor. For example, the Applicant's specification at paragraph [0020] indicates the following:

"Integrated circuits and electrical components thereof, which can be produced at a molecular and nanometer scale, include devices such as carbon nanotubes and nanowires,

which essentially are nanoscale conductors ("nanoconductors"). Nanoconductors are tiny conductive tubes (i.e., hollow) or wires (i.e., solid) with a very small size scale (e.g., 0.7 to 300 nanometers in diameter and up to 1mm in length)."

Similarly, the Applicant's specification at paragraph [0087] indicates the following:

"The network of nanoconnections depicted in FIG. 3 can be implemented as a network of molecules, including, for example, nanoconductors. Examples of nanoconductors include devices such as, for example, nanowires, nanotubes, and nanoparticles."

It is thus clear that such nanoconductors are not taught, disclosed or suggested by Thakoor. Additionally, the Applicant notes that the Thakoor reference does not teach, disclose or suggest a neural network based on nanoconductors disposed and free to move about within a dielectric medium.

Additionally, column 3133, left column, lines 1-14 of Thakoor does not provide for any hint, suggestion or teaching of a learning mechanism and specifically, Hebbian learning. Instead column 3133, left column, lines 1-14 of Thakoor refers generally to H+ ions, tungsten acid and chemical processes involved in the liberation of hydrogen and measurement of resistance. It is unclear how column 3133, left column, lines 1-14 of Thakoor constitutes "Hebbian learning" as taught by Applicant's invention.

The Applicant reminds the Examiner that in order to succeed in a rejection to a claim under 35 U.S.C. 102 based on a cited reference, that particular reference must disclose each and every claim limitation of the rejected claim (i.e., see the "prima facie anticipation" test referred to above). If even one claim limitation fails to be disclosed in the cited reference utilized as a basis for the rejection under 35 U.S.C. 102, then the rejection under 35 U.S.C. 102 fails and must be withdrawn. Thus, Thakoor fails to disclose nanoconductors, pre-synaptic and post-synaptic components, a learning mechanism, and Hebbian learning as taught by Applicant's claim 1. As such, the rejection to claim 1 based on Thakoor has been traversed.

The Applicant therefore respectfully requests withdrawal of the rejection to claim 1 under 35 U.S.C. 102.

Regarding claim 2, the Office Action argued that Thakoor teaches the system of claim 1 wherein said learning mechanism utilizes a voltage gradient to implement Hebbian plasticity within said physical neural network (the Office Action cited Thakoor, Figure 2 in support of this argument). The Applicant respectfully disagrees with this assessment and submits that the arguments presented above against the rejection to claim 1 apply equally to the rejection to claim 2. Figure 2 of Thakoor does not describe a learning mechanism as taught by Applicant's invention, and also does not provide for any teaching whatsoever of "Hebbian learning" as taught by Applicant's invention. Figure 2 of Thakoor also does not refer to Hebbian plasticity of a physical neural network. Instead, Figure 2 of Thakoor only illustrates a graph of resistance versus time (in minutes), and programming characteristics based on resistance versus time with respect to various voltages. This is not a learning mechanism, Hebbian learning and Hebbian plasticity as taught by Applicant's claim 2. Based on the foregoing, the Applicant submits that the rejection to claim 2 has been traversed. The Applicant respectfully requests withdrawal of the rejection to claim 2 under 35 U.S.C. 102.

Regarding claim 3, the Office Action argued that Thakoor teaches the system of claim 1 wherein said learning mechanism utilizes voltage gradient dependencies associated with physical neural network to implement Hebbian learning within said physical neural network (the Office Action cited Thakoor, Figure 2 in support of this argument). The Applicant respectfully disagrees with this assessment and submits that the arguments presented above against the rejection to claim 1 apply equally to the rejection to claim 3. Figure 2 of Thakoor does not describe a learning mechanism as taught by Applicant's invention, and also does not provide for any teaching whatsoever of "Hebbian learning" as taught by Applicant's invention. Instead, Figure 2 of Thakoor only illustrates a graph of resistance versus time (in

minutes), and programming characteristics based on resistance versus time with respect to various voltages. This is not a learning mechanism or Hebbian learning as taught by Applicant's claim 3. Based on the foregoing, the Applicant submits that the rejection to claim 3 has been traversed. The Applicant respectfully requests withdrawal of the rejection to claim 3 under 35 U.S.C. 102.

Regarding claim 4, the Office Action argued that Thakoor teaches the system of claim 1 wherein said learning mechanism utilizes pre-synaptic and post-synaptic frequencies to provide Hebbian learning within said physical neural network (the Office Action cited page 3132, left column, lines 24-41; and page 3133, left column, lines 1-14 in support of this argument). The Applicant respectfully disagrees with this assessment and submits that the arguments presented above against the rejection to claim 1 apply equally against the rejection to claim 4. Neither page 3132, left column, lines 24-41 nor page 3133, left column, lines 1-14 of Thakoor provide for any disclosure, teaching and/or suggestion of "Hebbian learning". Additionally, as indicated earlier there is no disclosure in Thakoor of "pre-synaptic" and "post-synaptic" components. Based on the foregoing, the Applicant submits that the rejection to claim 4 has been traversed. The Applicant respectfully requests withdrawal of the rejection to claim 4 under 35 U.S.C. 102.

Regarding claim 5, the Office Action argued that Thakoor teaches the system of claim 1 wherein said learning mechanism utilizes a voltage gradient to implement anti-Hebbian plasticity within said physical neural network (the Office Action cited Figure 2 of Thakoor in support of this argument). The Applicant respectfully disagrees with this assessment and submits that the arguments presented above against the rejection to claim 1 apply equally against the rejection to claim 5. Also, Figure 2 of Thakoor does not provide for any teaching of anti-Hebbian plasticity. Instead, Figure 2 of Thakoor only illustrates a graph of resistance versus time (in minutes), and programming characteristics based on resistance versus time with respect to various voltages. This is not anti-Hebbian plasticity as taught by

Applicant's claim 5. Based on the foregoing, the Applicant submits that the rejection to claim 5 has been traversed. The Applicant respectfully requests withdrawal of the rejection to claim 5 under 35 U.S.C. 102.

Regarding claim 6, the Office Action argued that Thakoor teaches the system of claim 1 wherein said learning mechanism utilizes voltage gradient dependencies associated with the physical neural network to implement anti-Hebbian learning within the physical neural network (the Office Action cited Figure 2 of Thakoor in support of this argument). The Applicant respectfully disagrees with this assessment and submits that the arguments presented above against the rejection to claim 1 apply equally against the rejection to claim 6. Figure 2 of Thakoor does not provide for any teaching of anti-Hebbian plasticity. Instead, Figure 2 of Thakoor only illustrates a graph of resistance versus time (in minutes), and programming characteristics based on resistance versus time with respect to various voltages. This is not anti-Hebbian plasticity as taught by Applicant's claim 6. Based on the foregoing, the Applicant submits that the rejection to claim 6 has been traversed. The Applicant respectfully requests withdrawal of the rejection to claim 6 under 35 U.S.C. 102.

Regarding claim 7, the Office Action argued that Thakoor teaches the system of claim 1 wherein said learning mechanism utilizes pre-synaptic and post-synaptic frequencies to provide anti-Hebbian learning within said physical neural network (the Office Action cited page 3132, left column, lines 24-41; and page 3133, left column, lines 1-14 in support of this argument). The Applicant respectfully disagrees with this assessment and submits that the arguments presented above against the rejection to claim 1 apply equally against the rejection to claim 7. Thakoor at page 3132, left column, lines 24-41; and page 3133, left column, lines 1-14, does not teach anti-Hebbian learning as taught by Applicant's invention, nor a learning mechanism as taught by Applicant's invention. Additionally, Thakoor at page 3132, left column, lines 24-41; and page 3133, left column, lines 1-14 does

not teach pre- and post-synaptic components and nanoconductors as taught by Applicant' claim 7. Based on the foregoing, the Applicant submits that the rejection to claim 7 has been traversed. The Applicant respectfully requests withdrawal of the rejection to claim 7 under 35 U.S.C. 102.

Regarding claim 9, the Office Action argued that Thakoor teaches the system of claim 1 wherein said plurality of nanoconductors includes nanoconductors comprising nanowires (the Office Action cited page 3133, left column, lines 4-5 of Thakoor in support of this argument). The Applicant respectfully disagrees with this assessment and submits that the arguments presented above against the rejection to claim 1 apply equally against the rejection to claim 9. Page 3133, left column, lines 4-5 of Thakoor does not teach, disclose or suggest "nanowires" as taught by Applicant's claim 9. Instead, page 3133, left column, lines 4-5 of Thakoor indicates only that "the rate of formation of H_xWO_3 depends primarily on the control voltage". H_xWO_3 is a chemical compound, but not a nanowire as taught by Applicant's claim 9. There is no disclosure here of nanowires as taught by Applicant's claim 9. Based on the foregoing, the Applicant submits that the rejection to claim 9 has been traversed. The Applicant respectfully requests withdrawal of the rejection to claim 9 under 35 U.S.C. 102.

Regarding claim 10, the Office Action argued that Thakoor teaches the system of claim 1 wherein said plurality of nanoconductors includes nanoconductors comprising nanoparticles (the Office Action cited page 3133, left column, lines 4-5 in support of this argument). The Applicant respectfully disagrees with this assessment and submits that the arguments presented above against the rejection to claim 1 apply equally against the rejection to claim 10. Page 3133, left column, lines 4-5 of Thakoor does not teach, disclose or suggest "nanoparticles" as taught by Applicant's claim 10. Instead, page 3133, left column, lines 4-5 of Thakoor indicates only that "the rate of formation of H_xWO_3 depends primarily on the control voltage". H_xWO_3 is a chemical compound, but not a nanoparticle as taught by

Applicant's claim 10. There is no disclosure here of nanoparticles as taught by Applicant's claim 10. Based on the foregoing, the Applicant submits that the rejection to claim 10 has been traversed. The Applicant respectfully requests withdrawal of the rejection to claim 10 under 35 U.S.C. 102.

Regarding claim 11, the Office Action argued that Thakoor teaches a system, comprising:

a physical neural network configured utilizing nanotechnology (the Office Action cited "title" in support of this argument), wherein said physical neural network comprises a plurality of nanoconductors which form neural connections between pre-synaptic and post-synaptic components of said physical neural network (the Office Action cited page 3132, left column, lines 24-41 of Thakoor in support of this argument; and

a learning mechanism for applying Hebbian learning to said physical neural network wherein said learning mechanism utilizes a voltage gradient or pre-synaptic and post-synaptic frequencies thereof to implement Hebbian or anti-Hebbian plasticity within said physical neural network (the Office Action cited page 3133, left column, lines 1-14 of Thakoor in support of this argument).

The Applicant respectfully disagrees with this assessment. Thakoor at page 3132, left column, lines 24-41 does not make any mention of nanoconductors, or pre-synaptic and post-synaptic components of a physical neural network. Thakoor does refer generally to "neural network architectures" and "synapses" (see page 3132, left column, lines 22-24), but does not provide for any disclosure, teaching or suggestion of nanoconductors, and pre-synaptic and post-synaptic components of a physical neural network. Thakoor only refers generally to "neural network architectures" but does not describe a physical neural network and instead teaches a "memistor" device, which is not a physical neural network as taught by Applicant's invention. Thakoor does not provide any teaching anywhere of nanoconductors and pre-synaptic and post-synaptic components as taught by the Applicant's invention.

The Applicant provides for a teaching of "nanoconductors," which is not taught by Thakoor. For example, the Applicant's specification at paragraph [0020] indicates the following:

> "Integrated circuits and electrical components thereof, which can be produced at a molecular and nanometer scale, include devices such as carbon nanotubes and nanowires, which essentially are nanoscale conductors ("nanoconductors"). Nanoconductors are tiny conductive tubes (i.e., hollow) or wires (i.e., solid) with a very small size scale (e.g., 0.7 to 300 nanometers in diameter and up to 1mm in length)."

Similarly, the Applicant's specification at paragraph [0087] indicates the following:

> "The network of nanoconnections depicted in FIG. 3 can be implemented as a network of molecules, including, for example, nanoconductors. Examples of nanoconductors include devices such as, for example, nanowires, nanotubes, and nanoparticles."

It is thus clear that such nanoconductors are not taught, disclosed or suggested by Thakoor.

Additionally, column 3133, left column, lines 1-14 of Thakoor does not provide for any hint, suggestion or teaching of a learning mechanism and specifically, Hebbian learning. Instead column 3133, left column, lines 1-14 of Thakoor refers generally to H+ Ions, tungsten acid and chemical processes involved in the liberation of hydrogen and measurement of resistance. It is unclear how column 3133, left column, lines 1-14 of Thakoor constitutes "Hebbian learning" as taught by Applicant's invention. It is also unclear how column 3133, left column, lines 1-14 of Thakoor discloses Hebbian or anti-Hebbian plasticity

The Applicant reminds the Examiner that in order to succeed in a rejection to a claim under 35 U.S.C. 102 based on a cited reference, that particular reference must disclose each and every claim limitation of the rejected claim (i.e., see the "prima facie anticipation" test referred to above). If even one claim limitation fails to be disclosed in the cited reference utilized as a basis for the rejection under 35 U.S.C. 102, then the rejection under 35 U.S.C. 102 fails and must be withdrawn. Thus, Thakoor fails to disclose nanoconductors, pre-synaptic and post-synaptic

components, a learning mechanism, Hebbian learning and Hebbian or anti-Hebbian plasticity as taught by Applicant's claim 11. As such, the rejection to claim 11 based on Thakoor has been traversed. The Applicant therefore respectfully requests withdrawal of the rejection to claim 11 under 35 U.S.C. 102.

Regarding claim 13, the Office Action argued that Thakoor teaches the system of claim 11 wherein said plurality of nanoconductors includes nanoconductors comprising nanowires (the Office Action cited page 3133, left column, lines 4-5 in support of this argument). The Applicant respectfully disagrees with this assessment and submits that the arguments presented above against the rejection to claim 11 apply equally against the rejection to claim 13. Page 3133, left column, lines 4-5 of Thakoor does not teach, disclose or suggest "nanowires" as taught by Applicant's claim 9. Instead, page 3133, left column, lines 4-5 of Thakoor indicates only that "the rate of formation of H_xWO_3 depends primarily on the control voltage". H_xWO_3 is a chemical compound, but not a nanowire as taught by Applicant's claim 13. There is no disclosure here of nanowires as taught by Applicant's claim 13. Based on the foregoing, the Applicant submits that the rejection to claim 13 has been traversed. The Applicant respectfully requests withdrawal of the rejection to claim 13 under 35 U.S.C. 102.

Regarding claim 14, the Office Action argued that Thakoor teaches the system of claim 11 wherein said plurality of nanoconductors includes nanoconductors comprising nanoparticles (the Office Action cited page 3133, left column, lines 4-5 in support of this argument). The Applicant respectfully disagrees with this assessment and submits that the arguments presented above against the rejection to claim 11 apply equally against the rejection to claim 14. Page 3133, left column, lines 4-5 of Thakoor does not teach, disclose or suggest "nanoparticles" as taught by Applicant's claim 10. Instead, page 3133, left column, lines 4-5 of Thakoor indicates only that "the rate of formation of H_xWO_3 depends primarily on the control voltage". H_xWO_3 is a chemical compound, but not a nanoparticle as

taught by Applicant's claim 10. There is no disclosure here of nanoparticles as taught by Applicant's claim 14. Based on the foregoing, the Applicant submits that the rejection to claim 14 has been traversed. The Applicant respectfully requests withdrawal of the rejection to claim 14 under 35 U.S.C. 102.

Regarding claim 15, the Office Action argued that Thakoor teaches the system of claim 11 wherein said plurality of nanoconductors are disposed within a dielectric medium (the Office Action cited page 3133, left column, lines 1-4 in support of this argument). The Applicant respectfully disagrees with this assessment and submits that the arguments presented above against the rejection to claim 11 apply equally against the rejection to claim 15. Page 3133, left column, lines 1-4 of Thakoor refers generally to "an electric field that drives H^+ ions from Cr_2O_3 toward the cathodic WO_3" and to the "injection of H+ ions (protons)" and so forth, but not provide for a disclosure and/or teaching of nanoconductors disposed within a dielectric medium used for creating a physical neural network and wherein such a dielectric medium comprises a dielectric liquid. As indicated earlier, Thakoor does not disclose, suggest and/or teach nanoconductors as taught by Applicant's invention.

Thakoor does not disclose, suggest or teach a dielectric liquid as taught by Applicant's amended clam 15. The Applicant has amended claim 15 to further define the dielectric medium as constituting a dielectric liquid. It is believed that support for this amendment is provided and enabled by Applicant's specification. For example, paragraph [00106] of Applicant's specification teaches a "dielectric medium (e.g., a dielectric solvent or dielectric solution)". Paragraph [00186] of Applicant's specification also refers to "a solution of nano-conductors and a dielectric medium (e.g., a dielectric solvent)". Page 3133, left column, lines 1-4 of Thakoor does not provide for a teaching of a dielectric liquid as taught by Applicant's amended clam 15. Based on the foregoing, the Applicant submits that

the rejection to claim 15 has been traversed. The Applicant respectfully requests withdrawal of the rejection to claim 15 under 35 U.S.C. 102.

Regarding claim 16, the Office Action argued that Thakoor teaches the system of claim 15 wherein said plurality of nanoconductors form physical neural connections when said dielectric medium is exposed an electric field, such that said physical neural connections can be strengthened or weakened depending upon a strengthening or weakening of said electric field or an alteration of a frequency thereof (the Office Action cited page 3133, left column, lines 1-14 in support of this argument). The Applicant respectfully disagrees with this assessment and notes that all of the arguments presented above against the rejection to claim 15 apply equally against the rejection to claim 16. Page 3133, left column, lines 1-14 of Thakoor does not disclose all of the following claim limitations of Applicant's claim 16: nanoconductors that form physical neural connections, the dielectric medium exposed to an electric field, and physical neural connections that can be strengthened or weakened depending upon a strengthening or weakening of said electric field or an alteration of a frequency thereof. Instead, page 3133, left column, lines 1-14 of Thakoor refers generally to "an electric field that drives H^+ ions from Cr_2O_3 toward the cathodic WO_3" and to the "injection of H+ ions (protons)" and so forth, but does not provide for a disclosure and/or teaching of nanoconductors disposed within a dielectric medium used for creating a physical neural network. There is also no disclosure here of neural connections and the strengthening or weakening of such neural connections. As indicated earlier, Thakoor also does not disclose, suggest and/or teach nanoconductors as taught by Applicant's invention. Based on the foregoing, the Applicant submits that the rejection to claim 16 has been traversed. The Applicant respectfully requests withdrawal of the rejection to claim 16 under 35 U.S.C. 102.

Regarding claim 17, the Office Action argued that Thakoor teaches a system, comprising:

a plurality of molecular conductors disposed within a dielectric medium (the Office Action cited page 3133, left column, lines 1-14 in support of this argument);

at least one input electrode in contact with said dielectric medium (the Office Action cited page 3133, left column, lines 1-14 in support of this argument); and

at least one output electrode in contact with said dielectric medium, wherein said plurality of molecular conductors form physical neural connections when said dielectric medium is exposed an electric field across said at least one input electrode and said at least one output electrode, such that said physical neural connections can be strengthened or weakened depending upon a strengthening or weakening of said electric field or an alteration of a frequency thereof (the Office Action cited page 3132, left column, lines 24-41; and page 3133, left column, lines 1-14 in support of this argument).

The Applicant respectfully disagrees with this assessment. Page 3133, left column, lines 1-14 of Thakoor does not disclose a "dielectric medium comprising a dielectric solvent or a dielectric solution" as taught by Applicant's amended clam 17. The Applicant has amended claim 17 to further define the dielectric medium as constituting a dielectric solvent or a dielectric solution. It is believed that support for this amendment is provided and enabled by Applicant's specification. For example, paragraph [00106] of Applicant's specification teaches a "dielectric medium (e.g., a dielectric solvent or dielectric solution)". Paragraph [00186] of Applicant's specification also refers to "a solution of nano-conductors and a dielectric medium (e.g., a dielectric solvent)". Page 3133, left column, lines 1-14 of Thakoor does not provide for a teaching of a "dielectric medium comprising a dielectric solvent or a dielectric solution" as taught by Applicant's amended clam 17.

Thakoor at page 3132, left column, lines 24-41 and page 3133, left column, lines 1-14 also does not make any mention of neural connections formed when the dielectric medium is exposed an electric field. Where are such neural connections disclosed by page 3132, left column, lines 24-41 and page 3133, left column, lines

1-14 of Thakoor? Additionally, Thakoor at page 3132, left column, lines 24-41 and page 3133, left column, lines 1-14 also does not disclose that the physical neural connections can be strengthened or weakened depending upon a strengthening or weakening of said electric field or an alteration of a frequency thereof.

The Applicant reminds the Examiner that in order to succeed in a rejection to a claim under 35 U.S.C. 102 based on a cited reference, that particular reference must disclose each and every claim limitation of the rejected claim (i.e., see the "prima facie anticipation" test referred to above). If even one claim limitation fails to be disclosed in the cited reference utilized as a basis for the rejection under 35 U.S.C. 102, then the rejection under 35 U.S.C. 102 fails and must be withdrawn. Thus, Thakoor fails to disclose nanoconductors, pre-synaptic and post-synaptic components, a learning mechanism, and Hebbian learning as taught by Applicant's claim 17. As such, the rejection to claim 17 based on Thakoor has been traversed. The Applicant therefore respectfully requests withdrawal of the rejection to claim 7 under 35 U.S.C. 102.

Regarding claim 18, the Office Action argued that Thakoor teaches the system of claim 17 further comprising a physical neural network comprising said plurality of molecular conductors disposed within a dielectric medium, said at least one input electrode in contact with said dielectric medium, and said at least one output electrode in contact with said dielectric medium (the Office Action cited page 3133, left column, lines 1-14 of Thakoor in support of this argument). The Applicant respectfully disagrees with this assessment and notes that the arguments presented above against the rejection to claim 17 apply equally against the rejection to claim 18.

Page 3133, left column, lines 1-14 of Thakoor does not disclose, suggest or teach a "dielectric medium comprising a dielectric solvent or a dielectric solution" as taught by Applicant's amended clam 18. The Applicant has amended claim 18 to further define the dielectric medium as constituting a dielectric solvent or a

dielectric solution. It is believed that support for this amendment is provided and enabled by Applicant's specification. For example, paragraph [00106] of Applicant's specification teaches a "dielectric medium (e.g., a dielectric solvent or dielectric solution)". Paragraph [00186] of Applicant's specification also refers to "a solution of nano-conductors and a dielectric medium (e.g., a dielectric solvent)". Page 3133, left column, lines 1-4 of Thakoor does not provide for a teaching of a "dielectric medium comprising a dielectric solvent or a dielectric solution" as taught by Applicant's amended clam 18. Based on the foregoing, the Applicant submits that the rejection to claim 18 has been traversed. The Applicant respectfully requests withdrawal of the rejection to claim 18 under 35 U.S.C. 102.

Regarding claim 19, the Office Action argued that Thakoor teaches the system of claim 18 further comprising a learning mechanism for applying Hebbian learning to said physical neural network wherein said learning mechanism utilizes a voltage gradient or pre-synaptic and post-synaptic frequencies thereof to implement Hebbian or anti-Hebbian plasticity within said physical neural network (the Office Action cited Figure 2 of Thakoor in support of this argument). The Applicant respectfully disagrees with this assessment and notes that the arguments presented above against the rejection to claim 18 apply equally against the rejection to claim 19.

Figure 2 of Thakoor does not describe a learning mechanism as taught by Applicant's invention, and also does not provide for any teaching whatsoever of "Hebbian learning" as taught by Applicant's invention. Instead, Figure 2 of Thakoor only illustrates a graph of reistance versus time (in minutes), and programming characteristics based on resistance versus time with respect to various voltages. This is not a learning mechanism or Hebbian learning as taught by Applicant's claim 19. Figure 2 also does not disclose Hebbian or anti-Hebbian plasticity as taught by Applicant's claim 19. Based on the foregoing, the Applicant submits that the

rejection to claim 19 has been traversed. The Applicant respectfully requests withdrawal of the rejection to claim 19 under 35 U.S.C. 102.

Regarding claim 20, the Office Action argued that Thakoor teaches the system of claim 18 wherein said physical neural network is configured as an integrated circuit chip utilizing nanotechnology (the Office Action cited Figure 3 of Thakoor in support of this argument). The Applicant respectfully disagrees with this assessment and notes that the arguments presented above against the rejection to claim 18 apply equally against the rejection to claim 20. Figure 3 of Thakoor does not illustrate an integrated circuit chip. Figure 3 also provides for no teaching of nanotechnology. Based on the foregoing, the Applicant submits that the rejection to claim 20 has been traversed. The Applicant respectfully requests withdrawal of the rejection to claim 20 under 35 U.S.C. 102.

IV. Claim Rejections – 35 U.S.C. § 103

Requirements for Prima Facie Obviousness

The obligation of the examiner to go forward and produce reasoning and evidence in support of obviousness is clearly defined at M.P.E.P. §2142:

> The examiner bears the initial burden of factually supporting any *prima facie* conclusion of obviousness. If the examiner does not produce a *prima facie* case, the applicant is under no obligation to submit evidence of nonobviousness.

M.P.E.P. §2143 sets out the three basic criteria that a patent examiner must satisfy to establish a *prima facie* case of obviousness:

1. some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings;

2. a reasonable expectation of success; and

3. the teaching or suggestion of all the claim limitations by the prior art reference (or references when combined).

It follows that in the absence of such a *prima facie* showing of obviousness by the Examiner (assuming there are no objections or other grounds for rejection), an applicant is entitled to grant of a patent. *In re Oetiker*, 977 F.2d 1443, 1445, 24 USPQ2d 1443 (Fed. Cir. 1992). Thus, in order to support an obviousness rejection, the Examiner is obliged to produce evidence compelling a conclusion that each of the three aforementioned basic criteria has been met.

Thakoor in view of Deepak Srivastava, et al.

Claims 8 and 12 were rejected by the Office Action under 35 U.S.C. 103(a) as being unpatentable over Thakoor as applied to claims 1-7, 9-11 and 13-20 above, and further in view of "Computational Nanotechnology with Carbon Nanotubes and Fullerenes," by Deepak Srivastava et al, hereinafter referred to as Srivastava.

The Office Action argued that the Thakoor teaches a physical neural network configured utilizing nanotechnology wherein said physical neural network comprises a plurality of nanoconductors. The Office Action admitted that Thakoor fails to disclose that said plurality of nanoconductors includes nanoconductors comprising nanotubes.

The Office Action asserted that Srivastava teaches computational nanotechnology with carbon nanotubes and fullerenes and that it would have been obvious at the time the invention was made to a person having ordinary skill in the art to combine the physical neural network utilizing nanotechnology of Thakoor with the carbon nanotubes of Srivastava. The Office Action argued that the motivation for doing so would be to perform complex computing and switching applications in a single pass and also, the signals propagated, branched, and switched on such a network need not be restricted to the "electronic" regime (the Office Action cited page 52, left column, lines 3-11 of Srivastava in support of this argument).

The Applicant respectfully disagrees with this assessment and submits that the arguments presented above against the rejection to claims 1-7, 9-11 and 13-20 under 35 U.S.C. 102 apply equally against the rejection to claims 8 and 12. Because as indicated earlier, the Thakoor reference does not disclose all of the claim limitations of the claims from which claims 8 and 12 depend, Thakoor cannot properly be combined with Srivastava as a basis for a rejection to claims 8 and 12 under 35 U.S.C. 103.

Srivastava does not provide for any teaching of neural networks nor any hint or suggestion of how the nanotubes or fullerenes described in the Srivastava could be adapted for use with a physical neural network as taught by Applicant's claims 8 and 12. Page 52, left column, lines 3-11 of Srivastava provides for no hint, suggestion, or teaching of a physical neural network as taught by Applicant's claims 8 and 12. Instead, page 52 left column, lines 3-11 merely refers to a "biological neural network" but does not indicate how a carbon nanotube could be adapted for use in the physical neural network taught by Applicant's claims 8 and 12. Additionally, as indicated above, Thakoor does not describe a physical neural network as taught by Applicant's claims 8 and 12. Thus, there is no motivation for combining Srivastava and Thakoor as argued by the Office Action to derive all of the claim limitations of Applicant's claims 8 and 12.

The Applicant submits that the rejection to claims 8 and 12 fails under all three prongs of the aforementioned prima facie obviousness test. First, there is no suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the references or to combine the reference teachings as suggested by the Office Action. Second, the Office Action has not provided an explanation of a "reasonable expectation of success" for such a combination, given that Srivastava provides absolutely no teaching of neural networks and neural network components, and Thakoor does not teach all of the claim limitations of Applicant's claims 8 and 12 and the claims from

which such claims depend. Third, Srivastava and Thakoor when combined do not provide for the teaching or suggestion of all the claim limitations of Applicant's claims 8 and 12.

Based on the foregoing, the Applicant submits that the rejection to claims 8 and 12 has been traversed. The Applicant respectfully requests withdrawal of the rejection to claims 8 and 12 under 35 U.S.C. 102.

IV. Conclusion

In view of the foregoing discussion, the Applicant has responded to each and every rejection of the Official Action. The Applicant has clarified the structural distinctions of the present invention. Applicant respectfully requests the withdrawal of the rejections under 35 U.S.C. §102 and §103 based on the preceding remarks. Reconsideration and allowance of Applicant's application is also respectfully solicited.

Should there be any outstanding matters that need to be resolved, the Examiner is respectfully requested to contact the undersigned representative to conduct an interview in an effort to expedite prosecution in connection with the present application.

Respectfully submitted,

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